FISH MANAGEMENT REPORT 138

MARCH 1989

VALIDATING DORSAL SPINE READINGS OF WALLEYE AGE

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ABSTRACT

Walleyes (Stizostedion vitreum vitreum) from western Lake Superior were captured, marked and aged during their 1981 and 1984 spawning runs up the St. Louis River. Recaptures in 1984 and 1985 were re-aged. Ages were determined from sectioned dorsal spines by 2 readers, who each examined the transverse cross-sections twice. They found annuli changes equal to years at liberty on 48% (Reader 1) and 55% (Reader 2) of the spines. Their readings were within ±1 year on 69% and 76%, respectively, and both readers agreed within ±2 years on 79%. Because dorsal spines reliably indicated walleye age for this population, I recommend using them to collect such data for similar old-age or lightly exploited populations -- without killing fish. Furthermore, dorsal spines should be compared with other calcified structures for aging dead fish, and all aging methods should be verified.

CONTENTS

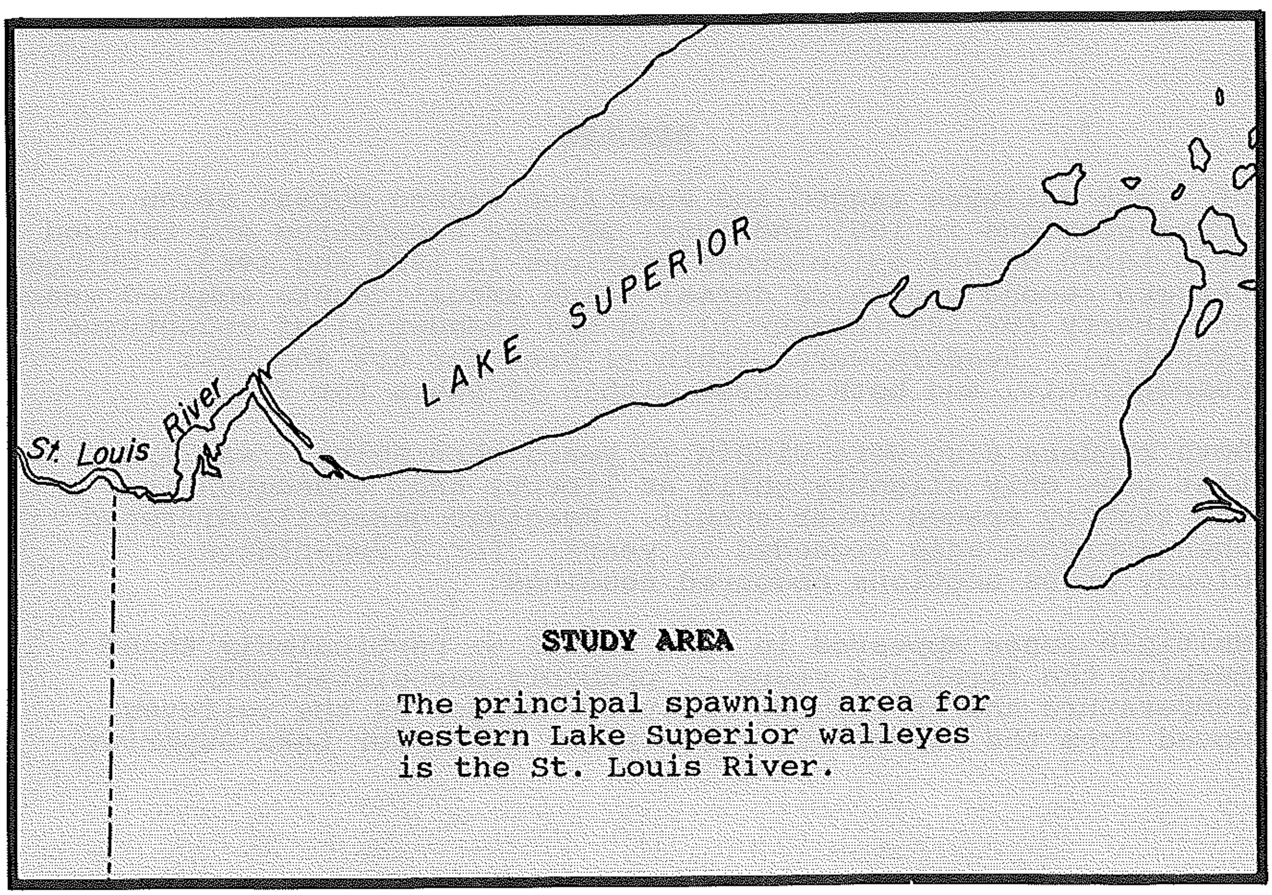
INTRODUCTION

Traditional scale analysis for aging walleyes (Stizostedion vitreum vitreum) can be unreliable -- especially in oligotrophic waters with stable populations -- where the compressed outer annuli of older fish generally cause age underestimates.

Campbell and Babaluk (1979) and Olson (1980) recommended using dorsal spines as an alternative to scales for determining age. Erickson (1983) preferred otoliths for the most accurate age estimates -- particularly for older walleyes -- but this method entails killing the fish.

Although Bagenal (1978) and Casselman (1983) stressed age validation as an essential component of any age and growth study, Beamish and McFarlane (1983) found such validatation neglected in fisheries biology. Few reported age validation studies support the growing acceptance of calcified structures as age determinants.

Schram (1980) showed that severely crowded annuli make scales unreliable for aging western Lake Superior walleyes. This study, therefore, attempts to validate dorsal spine aging for that population.



STUDY AREA

The principal spawning area for western Lake Superior walleyes is the St. Louis River.

METHODS

A D.C. electrofishing boat was used to intercept western Lake Superior walleyes during their 1981, 1984, and 1985 spawning runs up the St. Louis River. When first captured, each sampled walleye received a numbered Floy (FD 68 BC) anchor tag and had its second dorsal spine removed for aging (Margenau 1982). Recaptures had the third dorsal spine removed for aging. In 1981, 1,261 walleyes were tagged and first aged; in 1984, 224. Recaptures totaled 13 in 1984, 16 in 1985.

Two experienced readers examined transverse cross-sections of the collected dorsal spines at 40-power magnification under transmitted and reflected light. Each reader made 2 examinations 4 months apart. Reading discrepencies of 1 year were assigned half to the higher age and half to the lower age. The mean age resolved 2-year disparities. Other disagreements, however, caused rejection of the spine.

Because the walleyes were captured during spring, dorsal spine margins counted as annuli. When cloudy centers on a few cross-sections obscured the first annulus, back-calculations of lengths at the first annulus that corresponded with modal lengths for young-of-the-year walleyes (seine sampled from the St. Louis River during late-August and September) verified first annulus assignments.

RESULTS

Of 1,485 walleyes tagged and aged from second dorsal spine cross-sections in 1981 and 1984, 29 were recaptured and re-aged from third dorsal spine cross-sections in 1984 and 1985. Changes between second and third dorsal spine annuli counts equaled years at liberty for 48% (Reader 1) and 55% (Reader 2) of recaptures (Table 1). Readers were within ± 1 year for 69% and 76%, respectively, and both agreed within ± 2 years for 79%.

Both readers also were within ± 3 years when aging 4 walleyes that grew only slightly while at liberty and, consequently, had tightly spaced outer annuli. Readings generally differed when assigned ages exceeded 10 years. For 2 recaptures, cloudy cross-sections obscured readings.

Multiple zones appeared in some annuli -- particularly those marking the first 3-4 years -- probably associated with temperature and/or feeding activity changes as the walleyes moved from the warmer St. Louis River to cooler Lake Superior.

Table 1. Accuracy of dorsal spine annuli counts in showing known years at liberty for recaptured western Lake Superior walleyes.

	Reader 1		Reader 2	
Agreement	%	#	%	#
Exact	48%	14 fish	55%	16 fish
±1 year	21%	6 fish	21%	6 fish
±2 years	10%	3 fish	3%	1 fish
±3 years	14%	4 fish	14%	4 fish
Cloudy spine	7%	2 fish	7%	2 fish
Total	100%	29 fish	100%	29 fish

Dorsal spine cross-sections from 2 recaptures represent the findings that annuli formation equaled years at liberty (Fig. 1). A 526-mm female, estimated to be 6 years old when tagged in 1981 (Fig. 1-A), had grown 76 mm and was estimated to be 9 years old when recaptured in 1984 (Fig. 1-B). A 594-mm female, estimated to be 13 years old when tagged in 1981 (Fig. 1-C), had grown 46 mm and was estimated to be 17 years old when recaptured in 1985 (Fig. 1-D).

Opaque zones were much wider than translucent zones in younger walleyes (Figs. 1-A and 1-B), but the zones became similar in width as the fish grew older (Figs. 1-C and 1-D). The merged outer annuli of older walleyes complicated age determinations.

Of the 29 recaptured walleyes (Table 2), 6 were at liberty for 1 year (1984-85), 13 for 3 years (1981-84), and 10 for 4 years (1981-85). Assigned ages when tagged ranged from 5 to 15; assigned ages when recaptured, 6 to 18. Lengths when tagged ranged from 394 mm to 726 mm; lengths when recaptured, 424 mm to 734 mm. Seven recaptures were male; 22, female.

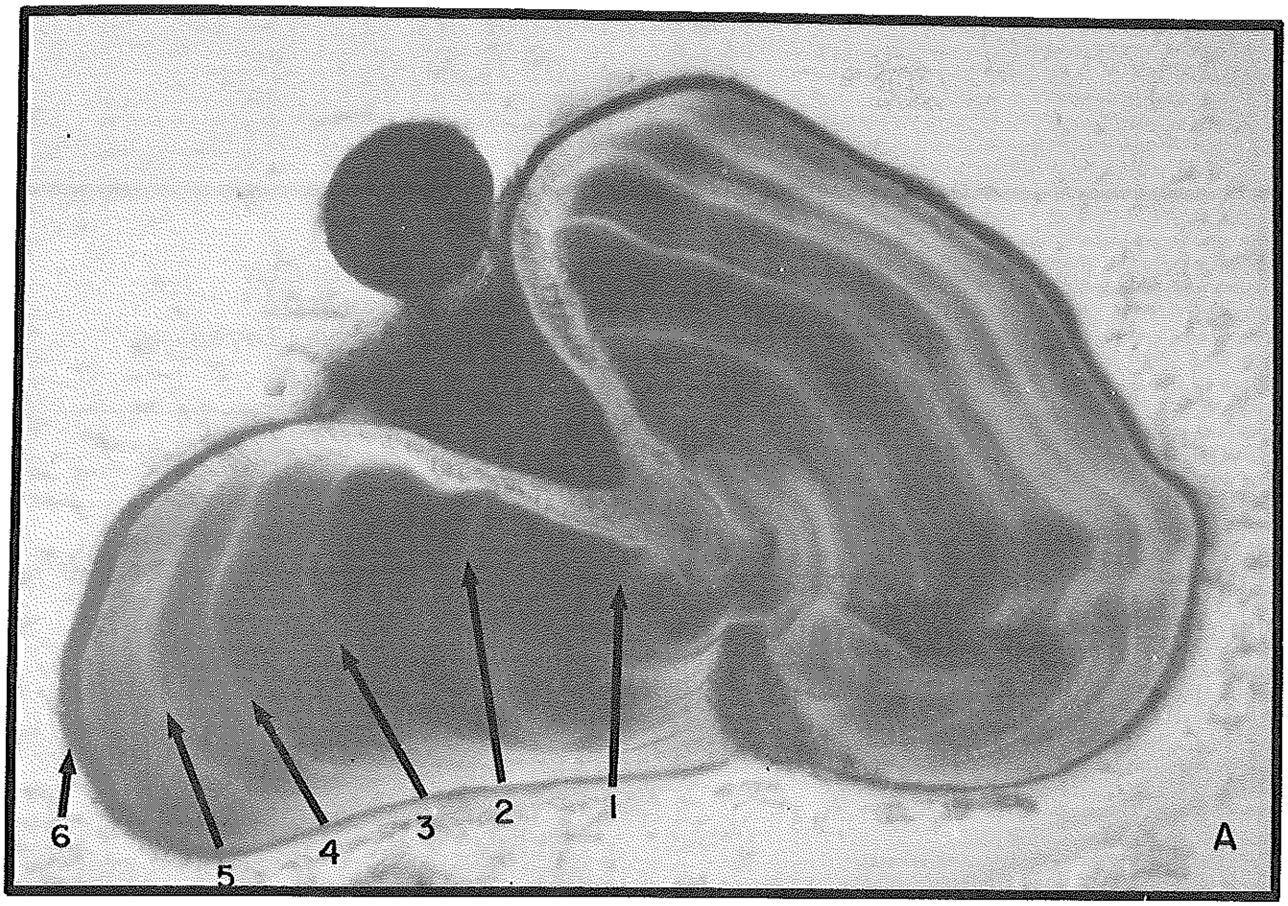
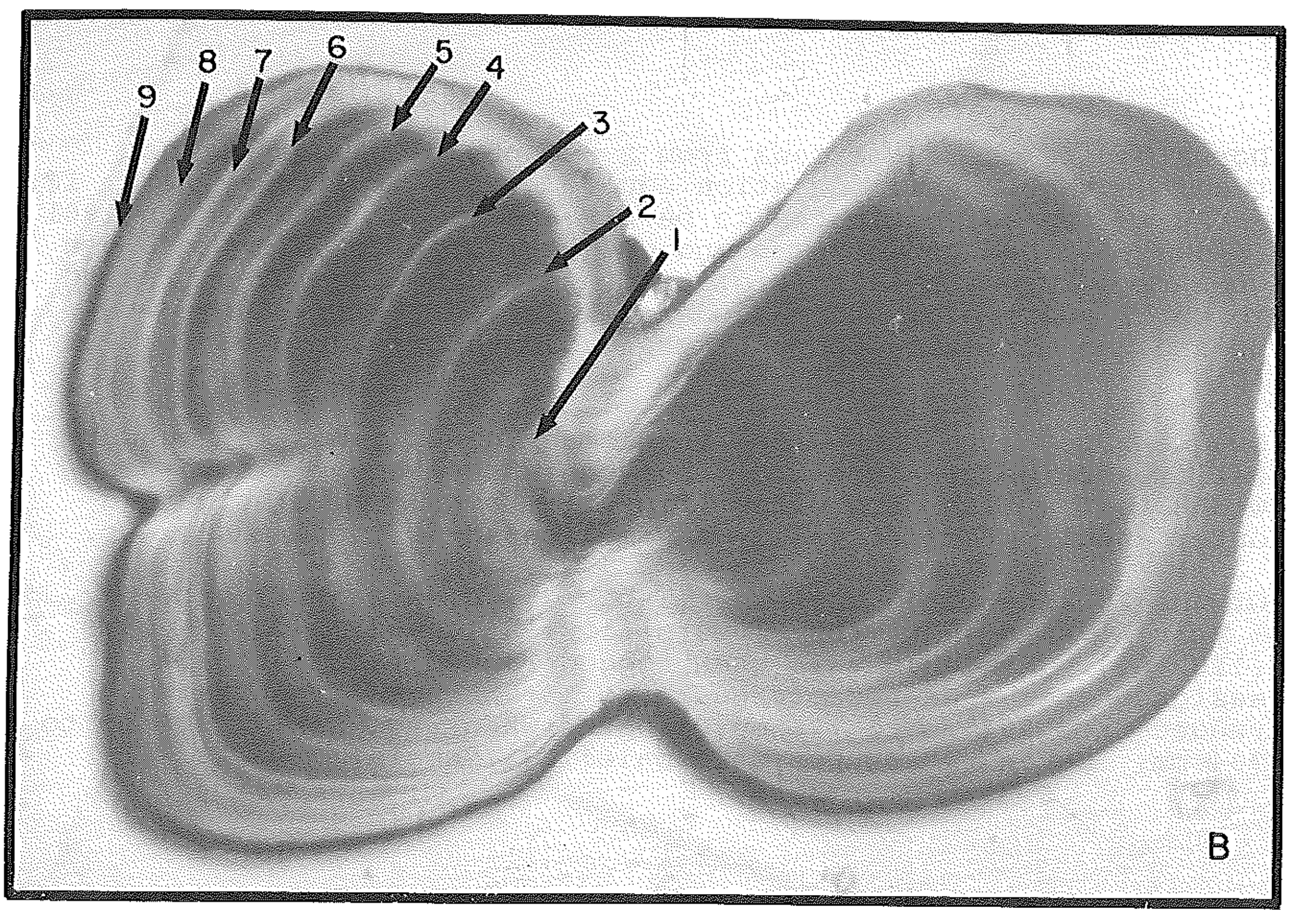
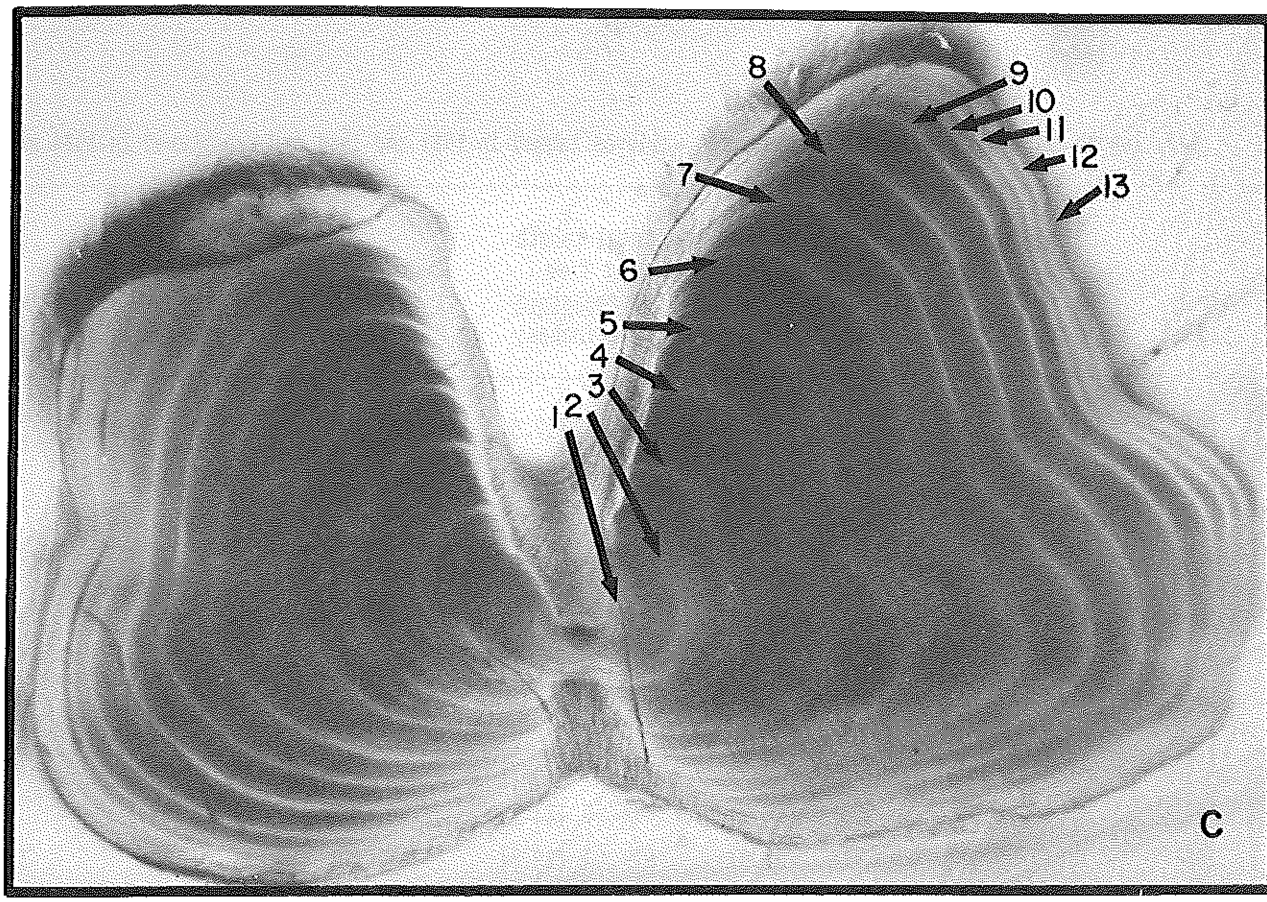


Figure 1. Transmitted light caused the annuli, translucent zones, to appear white in these photographs: (A) a 526-mm walleye at age 6; (B) the same fish at 602 mm when recaptured





3 years later at age 9; (C) a 594-mm walleye at age 13; (D) the same fish at 640 mm when recaptured 4 years later at age 17. (Scale: ———— = 1 mm.)

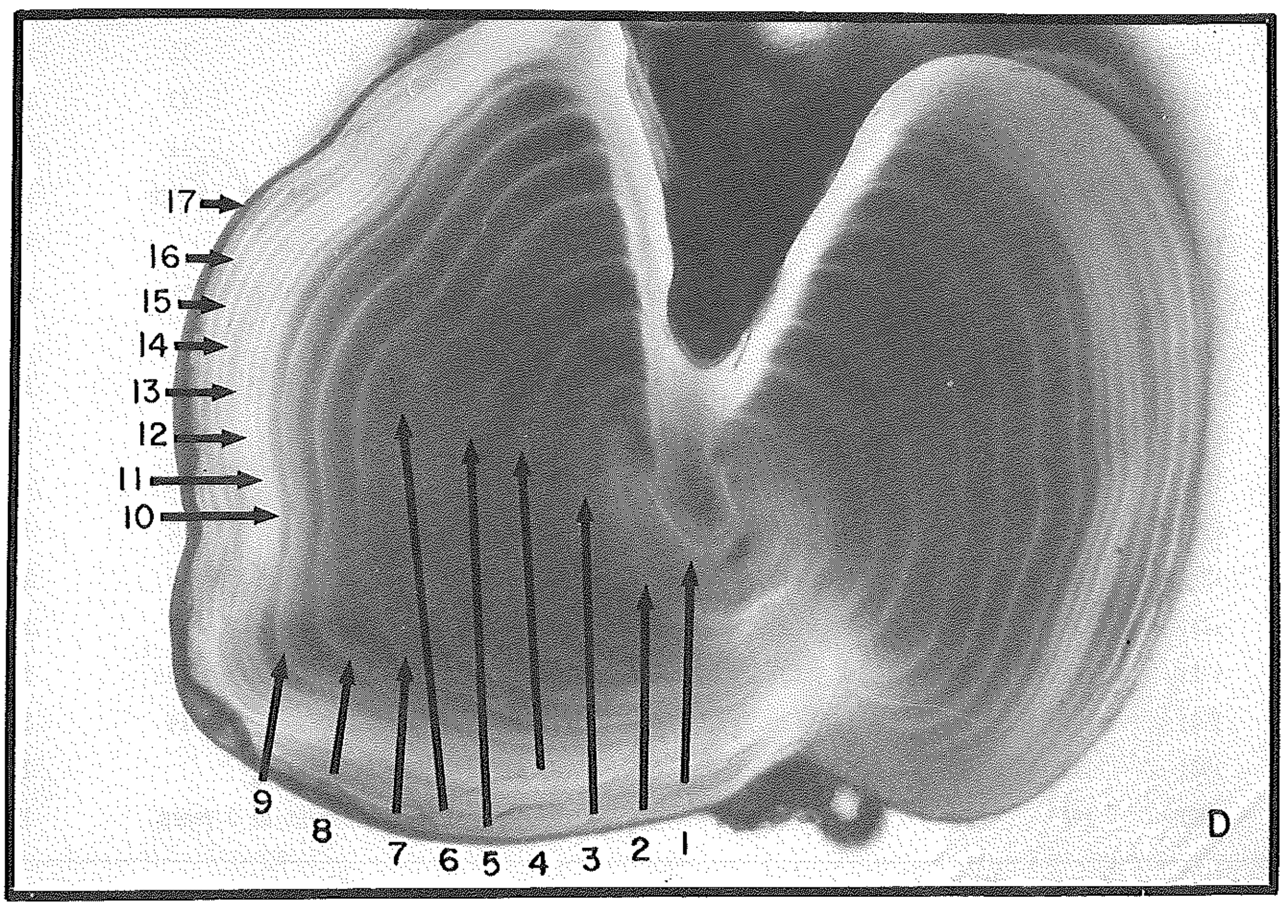


Table 2. Age, length and sex of western Lake Superior walleyes tagged in 1981 and 1984 and recaptured in 1984 and 1985.

Tag number	Year tagged	Year recaptured	Sex	Total length at time of tagging mm	(inches)	Total length at time of recapture mm	(inches)	Assigned age at time of tagging	Assigned Age at time of recapture	Days at Liberty
3543	1984	1985	M	439	(17.3)	445	(17.5)	8	9	369
3552	1984	1985	M	467	(18.4)	490	(19.3)	9	10	368
3602	1984	1985	M	394	(15.5)	424	(16.7)	5	6	367
3644	1984	1985	M	528	(20.8)	546	(21.5)	10	11	368
3992	1984	1985	F	485	(19.1)	526	(20.7)	8	9	367
3758	1984	1985	M	592	(23.3)	594	(23.4)	Disagreement of 3 years		368
11956	1981	1984	F	726	(28.6)	734	(28.9)	15	18	1,106
12125	1981	1984	F	526	(20.7)	602	(23.7)	6	9	1,107
12149	1981	1984	F	541	(21.3)	579	(22.8)	10	13	1,106
12330	1981	1984	M	533	(21.0)	546	(21.5)	14	17	1,104
12382	1981	1984	F	564	(22.2)	612	(24.1)	11	14	1,104
12595	1981	1984	F	638	(25.1)	653	(25.7)	15	18	1,102
12618	1981	1984	F	574	(22.6)	602	(23.7)	10	13	1,107
12678	1981	1984	F	498	(19.6)	582	(22.9)	8	11	1,101
12848	1981	1984	F	561	(22.1)	620	(24.4)	10	13	1,104
13177	1981	1984	F	521	(20.5)	572	(22.5)	8	11	1,102
13228	1981	1984	F	665	(26.2)	678	(26.7)	Disagreement of 3 years		1,106
12054	1981	1984	F	533	(21.0)	597	(23.5)	Cloudy spine		1,104
12767	1981	1984	F	594	(23.4)	607	(23.9)	Disagreement of 3 years		1,104
11729	1981	1985	M	483	(19.0)	521	(20.5)	9	13	1,471
11789	1981	1985	F	635	(25.0)	--	--	14	18	1,471
12411	1981	1985	F	556	(21.9)	602	(23.7)	12	16	1,469
12079	1981	1985	F	549	(21.6)	632	(24.9)	8	12	1,470
12240	1981	1985	F	551	(21.7)	610	(24.0)	11	15	1,468
12307	1981	1985	F	594	(23.4)	640	(25.2)	13	17	1,468
12529	1981	1985	F	538	(21.2)	610	(24.0)	11	15	1,469
12798	1981	1985	F	531	(20.9)	589	(23.2)	10	14	1,466
12043	1981	1985	F	635	(25.0)	655	(25.8)	Cloudy spine		1,469
12949	1981	1985	F	630	(24.8)	645	(25.4)	Disagreement of 3 years		1,470

DISCUSSION

Age and growth data are vital to any population dynamics study and often form the basis for examining other population parameters such as survival rates.

Dorsal spine analysis is reliable for aging western Lake Superior walleyes, except for some very slow-growing older individuals. Known time lapses validated cross-section annuli counts as 79% accurate within ±2 years, which was acceptable accuracy for this population with walleyes up to 20 years old.

While otoliths may be more accurate age indicators and less difficult to analyze (Erickson 1983), dorsal spines are more practical in fisheries management because fish can be released alive after spines are removed. Collecting spines in the field is also much easier than collecting otoliths. Furthermore, missing spines mark fish, which is useful for population or tag-loss estimates. During the 4-year study period, there was no noticeable regeneration of missing dorsal spines.

MANAGEMENT RECOMMENDATIONS

I recommend the following:

1. Use dorsal spine analysis to obtain reliable age data for old-age or lightly exploited populations. Conversely, for young, fast-growing populations, the extra time and expense of spines over scales may not be justified.

2. Compare dorsal spines, scales, otoliths, and other calcified structures to determine the appropriate method for aging dead fish.

3. Validate all aging methods.

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ACKNOWLEDGMENTS

I thank William Blust (WDNR Natural Resources Technician, Superior, WI) for valuable field assistance and advice.

John Casselman (Ontario Ministry of Natural Resources, Canada) and the late Steven Serns (former WDNR Research Biologist, Woodruff, WI) reviewed earlier drafts of the manuscript.

I also thank Michael Hansen (WDNR Fisheries Management Publications Coordinator, Madison, WI) and Kendra Nelson (WDNR Fisheries Management Publications Editor, Madison, WI).

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Currently, I am the WDNR Lake Superior Fisheries Manager at Bayfield, WI. I have a BS-Biology from Northern Michigan University and an MS-Outdoor Recreation and Field Biology from Central Michigan University. I have been working with Lake Superior salmonid and coolwater fisheries management since 1976.

This research addressed special aging problems with western Lake Superior walleyes, but I stress -- to all Great Lakes and inland fisheries managers -- the importance of validating any aging techniques.

I am also a member of the American Fisheries Society and the International Association for Great Lakes Research.

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